

CHARLES UNIVERSITY IN PRAGUE
FACULTY OF PHYSICAL EDUCATION AND SPORT
DEPARTMENT OF PHYSIOTHERAPY

BACHELOR DEGREE OF PHYSIOTHERAPY
BACHELOR THESIS

**CASE STUDY OF PHYSIOTHERAPEUTIC TREATMENT OF A
PATIENT AFTER TOTAL HIP ENDOPROSTHESIS**

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Abstract

Title: Case study of diagnosis of total hip endoprosthesis

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This Bachelor Thesis includes the treatment of the case of my patient who had an operation of total hip endoprosthesis 3 years ago, caused by osteoarthritis. Focusing in kinesiology and biomechanics of the hip after surgery and discuss its correlation with the low back.

My Bachelor Thesis consists of two parts: theoretical and practical parts. The theoretical part includes the anatomical, kinesiological and biomechanical aspects of the hip joint as well its connection with the lumbar after hip operation by possible complications which affect the low back.

In practical part I analysed every procedure I have done with my patient, all examinations and their conclusions and day to day therapy procedures and progress.

At the end of the therapy sessions, the patient had some important changes concerning her pelvis and spine, fascias, muscles as well as her gait pattern. More details about the progress of the patient included on the final kinesiology examination in the special part of this Bachelor Thesis.

KEY WORDS: Total hip endoprosthesis, Stability, Low back pain, Core stabilization system, Balance exercises

Declaration

I declare that this bachelor thesis has been entirely based on my own individual work and on my own practice that took place at Rehabilitační klinika Malvazinky in Prague from 12th of January 2015 until 23rd of January 2015.

The entire information gather in this bachelor thesis has been listed in the references, which exist at the end of the thesis. My practice was under supervision of my supervisors Mgr. Hanka Zemlerová and by PhDr. Tereza Nováková in Department of Physiotherapy, in Faculty of Physical Education and Sport of Charles University in Prague. I also want to mention that my patient was aware for all the examination procedures and therapies. Finally the patient and I signed a proposed informed approval.

Prague,
August, 2015

Maria Stylianidou

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1. Preface (Introduction)

My clinical practice took place at Rehabilitační klinika Malvazinky in Prague. My practical experience was scheduled for two weeks starting from 12th of January until the 23rd of January 2015.

I chose to write my Bachelor Thesis in a patient with diagnosis of Total Hip Endoprosthesis before 3 years because I found interest the situation of long-term outcomes after an operation like this.

Concerning the goals of the therapeutic plan was to improve core stabilization system, correct posture, improve balance during gait and maintain and improve fascias and muscles.

Regarding the theoretical part of the thesis, it is focused on the anatomy of the hip, the kinesiology and biomechanical point of view. Moreover there are included information about the examination procedures and the therapeutic sessions throughout my practice.

Furthermore in practical part I evaluate all the information that was possible to be obtained. That part of the thesis consists of the patient's anamnesis, initial and final examination, short and long rehabilitation plans, conclusion of examination and evaluation of the effect of therapy.

2. General Part

2.1. Anatomy of the hip joint

The hip joint is a ball and socket synovial type between the head of the femur and acetabulum of the pelvis. It connects the leg with the trunk, joining the lower limb to the pelvic girdle. The hip joint is an articulation designed for stability and weight bearing. It consists from layers starting with the deepest which is the bone, then ligaments of the capsules and on the top are the muscles. (1)

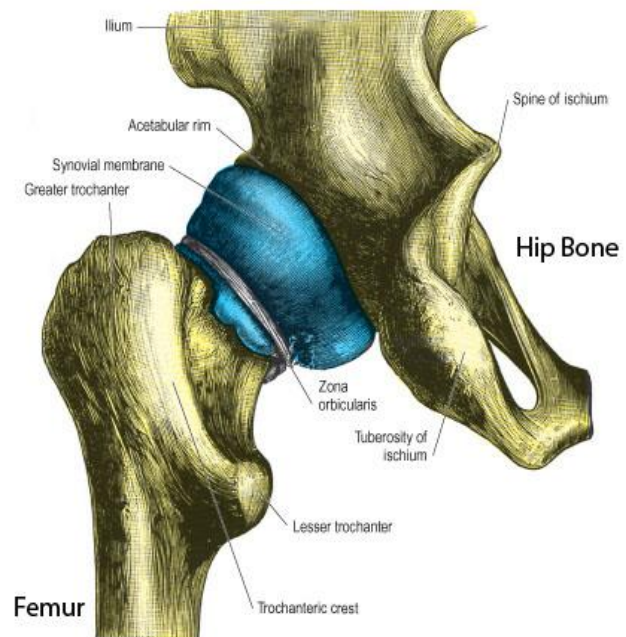


Figure 1: Hip joint

2.1.1. Bones of the hip joint

Acetabulum

The acetabulum is a cup like depression on the lateral surface of the pelvic bone in the region where the ilium, pubis and ischium fuse. The shape of acetabulum is a half of a sphere that almost entirely encompasses the hemispherical head of the femur and contributes substantially to joint stability.

The margin of the acetabulum is marked inferiorly by acetabular notch.

The wall of the acetabulum consists of nonarticular and articular parts.

Nonarticular part is rough and forms a shallow circular depression, the acetabulum fossa, in central and inferior parts of the acetabular floor.

Articular surface is broad and surrounds the anterior, superior and posterior margins of the acetabular fossa. The lunate surface is broadest superiorly where most of the body's weight is transmitted through the pelvis to the femur.

Head of femur

The femur, or thigh bone, is the longest, heaviest and strongest bone in the entire human body. All of the body's weight is supported by the femurs during many activities. Its proximal end called head of femur, a smooth, spherical process which articulates with acetabulum of the pelvic bone. The rounded shape of the head allows the femur to move in almost any direction at the hip. The head of femur is characterized by a nonarticular pit, fovea, on its medial surface for the attachment of the ligament of the head. (1), (5), (14)

2.1.2. Capsular ligaments

Three ligaments build up the external surface of the fibrous membrane and stabilize the joint. The iliofemoral ligament, pubofemoral ligament and ischiofemoral ligament have important roles in limiting and controlling the various movements of which the hip is capable. The fibers of all three ligaments are oriented in a spiral fashion around the hip joint.

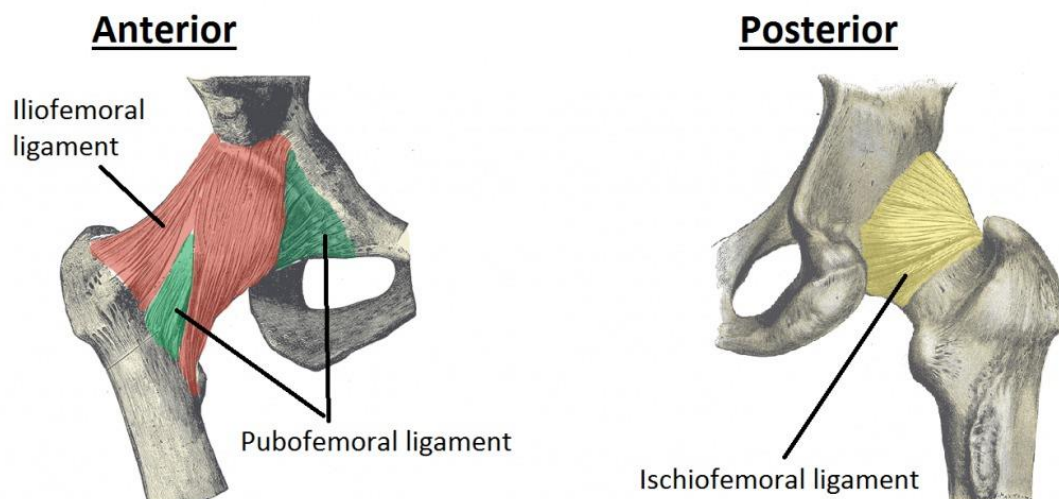


Figure 2: The extracapsular ligaments of the hip joint

Ilioferoral ligament

Is located to the anterior of the hip joint and it is very strong triangular ligament. Its apex is attached to the ilium between the anterior inferior iliac spine and the margin of the acetabulum and its base is attached along the intertrochanteric line of femur. The outer bands of the ligament attaching to the upper and lower parts of the intertrochanteric line are the strongest parts, with the central area being thinner and weaker. This results in the ligament having a Y appearance.

Pubofemoral ligament

It is also triangular in shape and is anteroinferior to the hip joint. It runs from the iliopubic eminence and superior pubic ramus to the lower part of the intertrochanteric line, blending with the inferior band of the iliofemoral ligament.

Ischiofemoral ligament

Supports the posterior aspect of the fibrous membrane. It arises from the body of the ischium behind and below the acetabulum attaching to the superior part of the neck and root of the greater trochanter. It is less well defined than either the iliofemoral or pubofemoral ligaments. (1), (5), (7)

2.1.3. Muscles of the hip joint

The muscles that move the thigh originate on the pelvis. Many are large and powerful. The muscles that move the thigh are grouped into the gluteal group, the lateral rotator group, the adductor group, the iliopsoas group, the hamstrings group and the quadriceps group.

Gluteal muscles

The gluteus maximus muscle is the largest and most superficial of the gluteal muscles. It originates along the posterior gluteal line and adjacent portions of the iliac crest, the sacrum, coccyx and associated ligaments and the thoracolumbar fascia. Acting alone, this massive muscle produces extension and lateral rotation at the hip.

The tensor fasciae latae muscle originates on the iliac crest and lateral surface of the anterior superior iliac spine. Tensor fasciae latae and gluteus maximus pull on the iliotibial tract, a band of collagen fibers that extends along the lateral surface of the thigh and inserts upon the tibia.

The gluteus medius and gluteus minimus muscles originate anterior to the gluteus maximus and insert upon the greater trochanter of the femur. Both produce abduction and medial rotation at the hip joint.

Lateral rotators

The six lateral rotators originate at the horizontal axis of the acetabulum and insert on the femur. All cause lateral rotation of the thigh, additionally, the piriformis muscle produces abduction at the hip. The piriformis and the obturator muscles, externus and internus are the

dominant lateral rotators. Lateral rotators are also *glutei superior* and *inferior* muscles and *quadratus femoris*.

Adductors

The adductors are located inferior to the acetabular surface. The adductors include the adductor magnus, adductor brevis, adductor longus, pectineus and gracilis muscles.

All of the adductors originate on the pubis, both anterior and inferior to the hip joint, so they produce flexion, adduction, and medial rotation at the hip. The adductor magnus muscle can produce either adduction and flexion or adduction and extension, depending on the region stimulated. The gracilis, in addition to adducting the hip joint, flexes and medial rotates the knee joint.

Iliopsoas

The psoas major muscle originates alongside the inferior thoracic and lumbar vertebrae and its insertion lies on the lesser trochanter of the femur.

Iliacus muscle lies on the iliac fossa and inserts just distal to the lesser trochanter. These two muscles, which are powerful flexors of the hip joint, are often referred to as the iliopsoas muscle.

Hamstrings

Biceps femoris, semimembranosus and semitendinosus muscles originate along the edges of the pelvis and insert upon the tibia and fibula. Their contractions produce flexion at the knee together with Sartorius muscle. Because the biceps femoris, semimembranosus, and semitendinosus muscles originate on the pelvis inferior and posterior to the acetabulum, their contractions also produce extension at the hip. These muscles are often called the hamstrings.

Quadriceps

The three vastus muscles, vastus lateralis, vastus medialis, and vastus intermedius originate along the body of the femur with the rectus femoris muscle originates on the anterior inferior iliac spine. All four muscles insert upon the tibial tuberosity via the quadriceps tendon, patella, and patellar ligament, and produce extension of the knee. The rectus femoris muscle in addition to producing extension of the knee, it can assist in flexion of the hip. (1), (5), (7)

2.2. Kinesiology of the hip

The hip joint serves as a central pivot point for the body as a whole. It is very important in weight bearing and walking activities. This large ball and socket joint allows simultaneous, triplanar movements of the femur relative to the pelvis, as well as the trunk and pelvis relative to the femur. (15)

The convex shaped femoral head fits into and articulates with the concave shaped acetabulum. The convex femoral head slides in the direction opposite the movement of the thigh. Hip is a very stable joint and therefore lose some range of motion. Being a triaxial joint, the motions of the hip joint are flexion and extension in the sagittal plane, with approximately 120 degrees of flexion and 15 degrees of extension.

Abduction and adduction occur in the frontal plane, with about 45 degrees of abduction. Adduction is usually thought of as the return to anatomical position, although there is approximately an additional 25 degrees of motion possible beyond the anatomical position. In the transverse plane, medial and lateral rotations are sometimes referred to as internal and external rotation. There are approximately 45 degrees of rotation possible in each direction from the anatomical position. (9)

Lifting the foot off the ground, reaching towards the floor or rapidly rotating the trunk and pelvis while supporting the body over one limb typically needs strong and specific activation of the hip's surrounding musculature. (15)

Abnormal performance of the muscles of the hip may modify the distribution of forces across the joint's articular surfaces, potentially causing, degenerative changes in the articular cartilage, bone and surrounding connective tissues.

When a particular muscle or muscle group is weak, painful, dominant or tight, can well affect the alignment across the lumbar spine, pelvis and femur, ultimately affecting the alignment throughout the entire lower limb. (9), (26)

2.3. Biomechanics of the hip

2.3.1. Loads of the hip

The hip is a major weight bearing joint that is never fully unloaded during daily activities. When body weight is uniformly distributed across both legs during upright standing, the weight supported at each hip is one half of the body segments weight above the hip or about one third of total body weight. The loading of weight on each hip is transmitted from the vertebral column through pelvis girdle. However, the total load on each hip is greater than the weight supported, because tension in large, strong hip muscles further adds to compression at the joint. (10), (11)

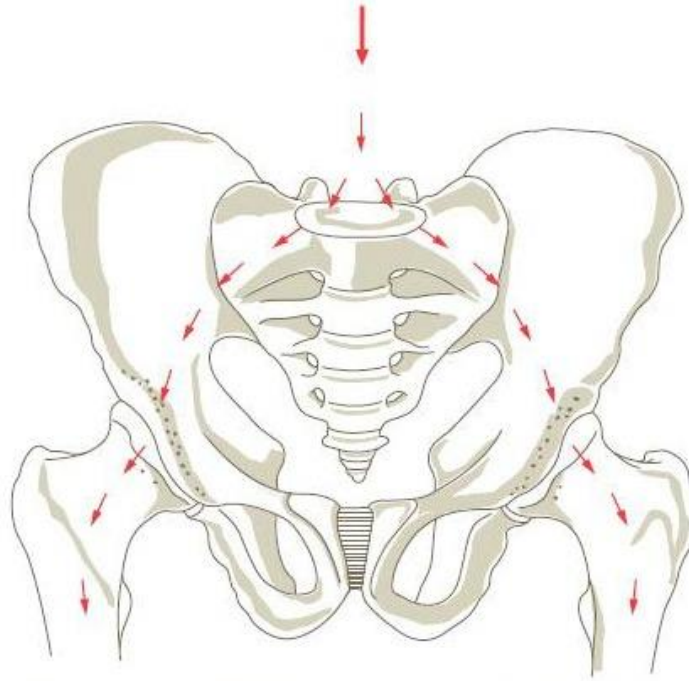


Figure 2: Transfer of weight to the lower limbs

2.3.2. Gait pattern after total hip endoprosthesis

The normal gait pattern consists of an alternating, rhythmical swinging forward of the leg and foot strike that involves almost all the joints and muscles of the human body. The gait cycle can be divided into a stance phase and a swing phase.

The stance phase includes the heel strike which is the point when the heel hits the floor, after that is the foot flat which occurs when the whole of the foot comes into contact with the floor, then is the mid stance, where the weight is transferring from the back to the front of the foot and last is the toe off, a pushing off with the toes to propel body forward.

In swing phase included the acceleration, the period of toe off from the ground, the mid swing, which is the period between maximum knee flexion and forward movement of the tibia and last is the deceleration which is the end of the swing phase before heel strike. (8), (27)

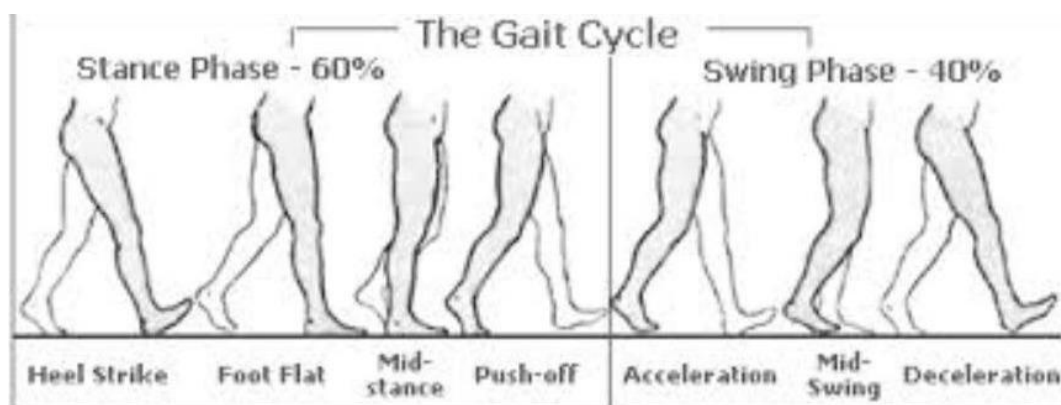


Figure 3: The gait cycle

Total hip endoprosthesis patients walk distinctly differently from normal elderly patients with normal gait patterns. Their abnormal gait patterns are likely to be, in part, mechanisms to reduce pain during gait. Their walk is typically characterized by a limp, which is thought to decrease pain by reducing the load on the hip. They walk at a slower walking speed which has also been shown to decrease limb loading.

Their asymmetrical gait further reduces limb loading on the affected side. However, their antalgic gait is also associated with a higher energy cost and a limited walking distance. (18)

2.3.3. Relationship between the hip and the low back

Biomechanical relationship between the hip and low back, related with the contraction of the multiple shared muscles, as m.psoas, m.quadratus lumborum, m.erector spinae, m.gluteus maximus that will affect motion at the spine, pelvis and hip because of common attachment sites. Movement at one of these areas will necessitate compensatory movement at the others because of these common muscle attachments and the concept of regional interdependence.

Also, hip ROM restrictions are correlated with low back. Decreased hip ROM, hip extensor strength and hip adductor or flexor endurance might contribute to pain in the lumbar spine. (19)

2.4. Complications after total hip endoprosthesis related with low back

2.4.1. Leg length discrepancy

The goals of total hip endoprosthesis include relieve of pain, improved mobility and stability of the hip joint, normal mechanics of the hip joint and, when is possible, equality of the leg length. Leg lengthening may be required to afford a stable hip joint after hip endoprosthesis surgery. (20)

Nonetheless, LLD causes pelvic obliquity in the frontal plane and lumbar scoliosis with convexity directed towards the short extremity. Lumbar scoliosis constitute guide rigid junction of L5 vertebra with sacral bone. Scoliosis which develops due to LLD is included within functional scoliosis. This type of scoliosis regresses totally or partially when its cause, that is LLD, is removed. (22)

LLD after total hip endoprosthesis has been associated also with other complications including sciatic, femoral and peroneal nerve palsy and abnormal gait.

Most patients with slight LLD after hip endoprosthesis surgery have few symptoms in comparison with patients with moderate LLD who have easily manageable symptoms. Patients with marked LLD may have substantial disability as a result of pain or instability of gait.

However, length discrepancies of up to 2 cm are almost common in the general population after total hip endoprosthesis. (20)

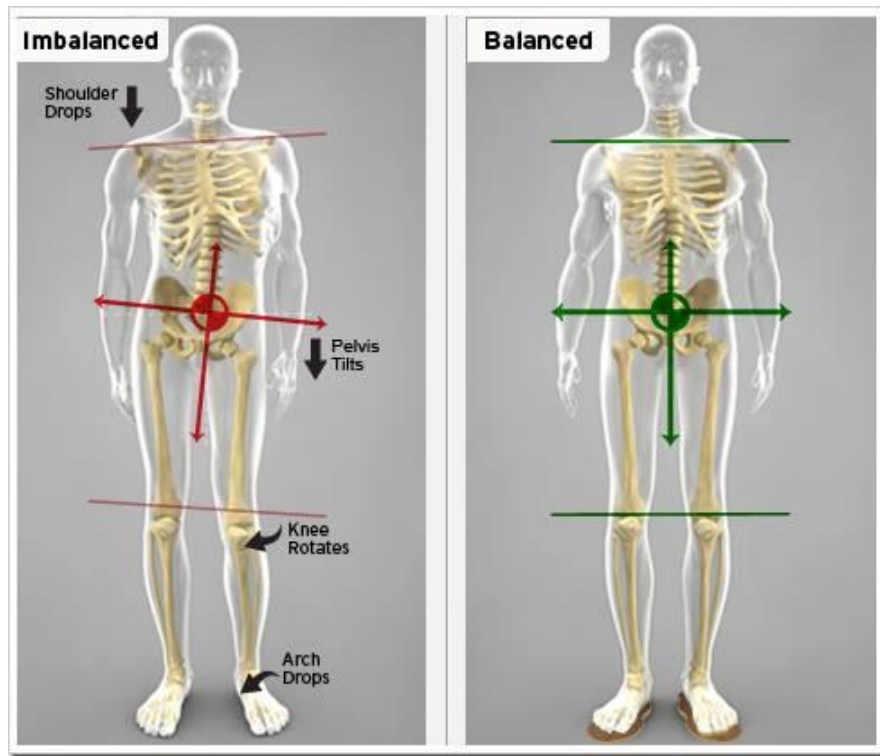


Figure 5: The role of LLD in standing position

2.4.2. Pelvic tilting

After total hip endoprosthesis, anterior or posterior tilt of the pelvis can affect the position of acetabular component in the sagittal plane of the body as compared with its normal anatomic position in the pelvis.

Anterior and posterior tilt of the pelvis can be result from the rotation that pelvis may have. The aging process and spinal impairments may lead to an altered sagittal balance. However, the pelvis and sacrum forms an inflexible structure, which translates and rotates around the bicoxofemoral axis for the necessary compensatory balance. After total hip endoprosthesis, an excessive pelvic tilting can cause dislocations, balance disturbances and low back pain. (21)

Our pelvis and low back were designed to work on a level plane. Therefore, most of the forces across the low back are linear and do not damage structures such as SI joint, iliolumbar ligament, piriformis and gluteus medius muscles.

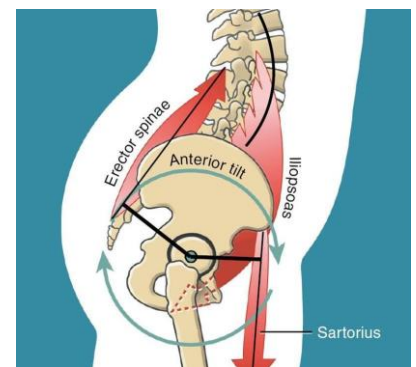


Figure 6: Anterior pelvic tilt

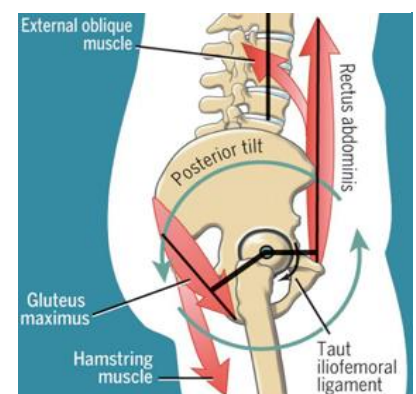


Figure 7: Posterior pelvic tilt

However, when there is pelvic tilting, the forces that hold the above mentioned structures become shearing, rather than linear. The ligaments, tendons and joints around low back and pelvis suffer and must withstand a greater force than those without a tilted pelvis. (12)

2.4.3. Limping

Limping can be defined as an asymmetrical gait. There are various types of limping that can occur after total hip endoprosthesis.

Protective or antalgic limp is one type of limping in which the patient shortens the stance phase of the operated foot, to reduce the pain. In this way, there is inclination of the torso towards the affected side and drooping of the hip joint on the other side resulting shifting of body to the affected hip joint in order to reduce the load and thus the pain.

Another limping type is the muscle weakness limp which can arise if the hip joint is dynamically or statically unstable due to the weakness of the abductors muscles. During gait, the swinging side leg is not raised and the patient shift toward the standing leg.

Since this can affect various factors as general condition, balance and strength, may also cause instability during walking, muscle imbalance, pain on low back and weight bearing disturbances. (8)

Balance of the spinal column requires the minimum force of the core muscles, abdominals located anteriorly and erector spinal muscles located posterior. Any condition that results in major displacement of the center of gravity of the body's mass away from the vertical axis of the spine will create increased forces in the stabilizing posterior erector spinal muscles in order to balance the spine. Limping consists of forward or lateral bending and lifting where this, in turn, cause increased force transmission across the spine segments. Each type of limp causes exaggerated bending and rotation of the trunk, it is probable that over time, this could accelerate normal aging change and thus cause back symptoms. The L4 - L5 and L5 - S1 spinal segments of normal individuals have the greatest motion in the lumbar spine. Greater motion causes an increased potential for lumbosacral disc breakdown. (13), (23)

2.5. Epidemiology

According to itemized research about the range of motion of flexion, abduction, adduction, external rotation and internal rotation of 1383 patients having total hip endoprosthesis, recorded the following results.

Postoperative hip motion was defined as high with 115 degrees of flexion, 25 degrees of abduction and 20 degrees of external rotation, average with 90-114 degrees of flexion, 16-24 degrees of abduction and 11-19 degrees of external rotation, or low with less than 90 degrees of flexion, 15 degrees or less of abduction and 10 degrees or less of external rotation motion. (16)

Most commonly observed complications occurring after primary total hip endoprosthesis are limping and leg length discrepancies, which understandably extent in patients after revision operations. The rare local complications than after primary operations are haematomas, infections, dislocations, fractures and neurological complications. (8)

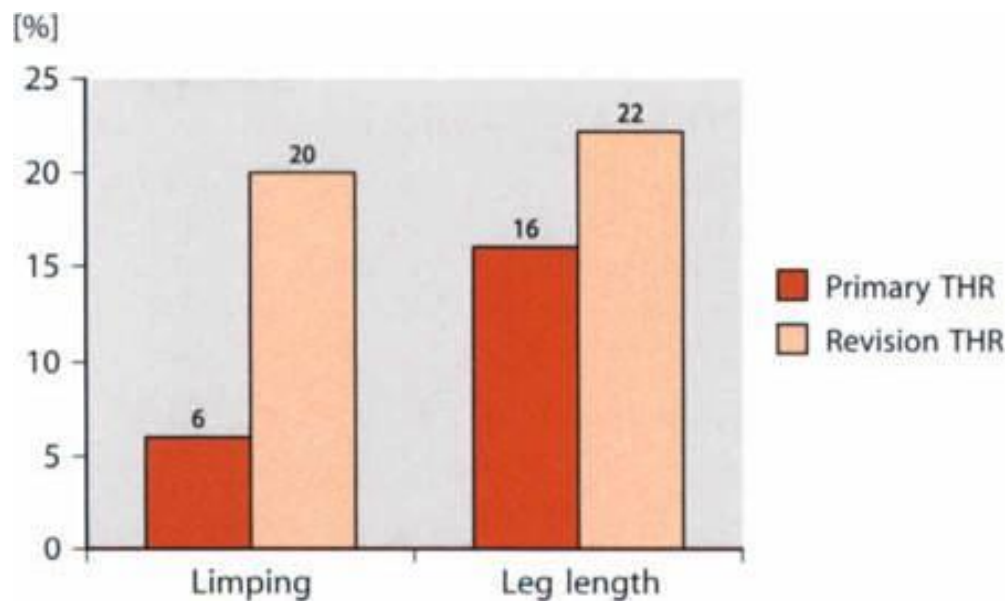


Figure 8: The most common local complications: limping and leg length discrepancy

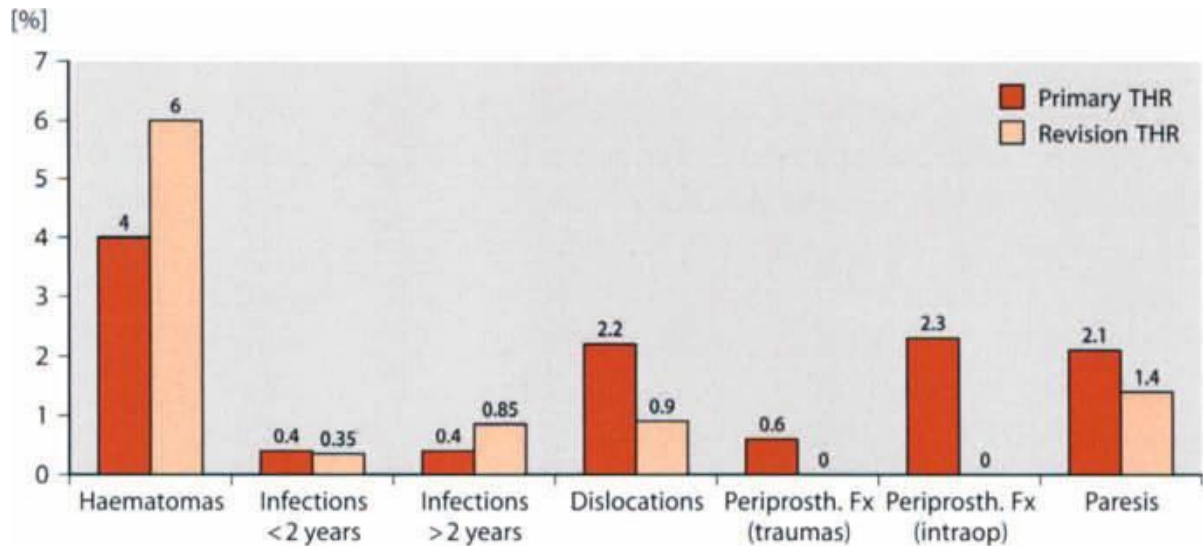


Figure 9: The rarer local complications

Many patients with degenerative joint disease of the hip have substantial degeneration of the lumbar spine. These patients may have back and lower extremity pain develop after total hip endoprosthesis and it may be difficult to determine whether the source of the pain is the hip or spine.

After a research has been done in 170 patients after total hip endoprosthesis surgery, 35 of them without prior low back pain had low back pain develop within 1 year postoperatively. (17)

2.6. Examination by the physiotherapist

2.6.1. Anamnesis-History

First of all examinations is anamnesis, the history information we can take from the patient's interview and is an integral part of clinical assessment. Anamnesis aims at the onset of the condition and the course of the symptoms, especially the information pertaining to pain. During the patient interview, we can also collect social information including family anamnesis-history, employment, living conditions, construction barriers and other information which are evaluated and judged always in the context of clinical assessment. (2)

2.6.2. Posture examination

An examination in erect standing position with inspection of dorsal, lateral and frontal aspects, using plumb line. The inspection begins with an assessment of overall posture, looking for any deviation from the plumb line and any asymmetries.

With systematic inspection we are working from feet and upward, examining specific points as position of various joints and body segments and relative weakness of the one side. (3)

2.6.3. Muscle tone examination (palpation)

After inspection, an examination which follows is palpation, an important diagnosis of painful structures of the locomotor system and essential for all manipulative techniques.

Muscle tone examination is important to sense heat and cold, to distinguish pressure, motion, position and tissue quality by placing hand onto the surface of the patient's body and then focus attention on the aspect to be tested. (3)

2.6.4. Gait examination

During clinical evaluation, the patient is examining without shoes and clothes, usually wearing only a swim suit or underwear. Gait is observed from front, back and side views.

Observation individual's body parts are carried out from bottom to top. At first, we note the type of foot contact. We assess the step symmetry, length and width. At the end of stance phase, we note whether terminal knee extension is achieved, as well as the angle of extension of the hip joint.

From the back we observe the movement of the spine and pelvis.

From frontal view we assess symmetrical involvement of all abdominal muscles and we observe whether there is an excessive activation of rectus abdominis during walking. Also, the movement of the upper extremities, thorax, head position and movements are noted. (2), (30)

2.6.5. Anthropometric measurements

During anthropometric measurements we take height, length and circumference in a relaxed position. Measurements could be in standing and sitting positions.

An acceptable error is 0,5cm when measuring extremities and 1cm when measuring the height of the body.

Firstly, we measure the height in standing position. Then we continue with the length of whole lower extremity measuring the anatomical length and the functional length. Length of the thigh, length of the middle leg and length of the foot are included to the measurements of whole lower extremity.

During the length of upper extremities we measure the whole upper extremity, the length of the humerus, the length of the forearm and the length of the hand.

Then, we continue with the measure the circumference, including circumference of thigh, of knee joint, of the calf, of the ankle, of the foot, of the upper arm and of the forearm. Some extra circumferences we can measure are the circumference of the head, and of the thorax evaluate the difference between positions of the thorax in the end of maximal breath in and breath out. (28)

2.6.6. Two scales test

The test is performed with patient standing on two different scales with one leg on each scale. The result must be symmetrical loading or if there is difference of weight bearing between both lower extremities must not be bigger than 10-15% of body weight. The greater difference indicates impaired balance. (29)

2.6.7. Range of Motion examination (ROM)

Range of motion is an active and passive movement examination which defines as change of position of body part in relation to another part of a body. It is measured with goniometer in lying, standing and sitting positions.

The starting position is selected by the goal of the treatment and by the abilities of the patient. Active is the movement performed by the patients muscle activity against gravity force. Passive is the movement without the muscular activity of the patient.

The range of motion is crucial for distinguish the severity of ones limitation on the other hand is important for practically demonstrate the improvement throughout rehabilitation plan. (27), (31)

2.6.8. Dynamic Spine examination

Is the spine examination including bending of the spine backward, sideways on both sides and forward. This examination analyses pain, excursions consist of the overall ROM of the spine movements, the spreading out or flattening of segments of the spine, the lateral symmetry and the return movement to the starting position. Moreover, the fluency of movement and curve. In case of an altered position of the pelvis, the spinal curves have to be observed as well as the function of the whole spine. (29)

2.6.9. Pelvis palpation

Pelvis palpation is provided to compare the height and symmetry of cristae iliacae, SIPSs and SIASs between the two sides of pelvis. Also, find the ideal position of pelvis, if pelvis rotation or torsion, anterior tilt, posterior tilt or lateral tilt of pelvis present. (29)

2.6.10. Muscle Strength test

A manual muscle testing is an attempt to determine the patient's ability to contract muscle group voluntarily and is important tool in the diagnosis, prognosis and treatment of musculoskeletal disorder.

To examine muscle strength there are some basic rules every examiner must know, which are:

Place patient in a position that offers the best fixation of the body as a whole.

Provide fixation of the part proximal to the tested one or some other part of the body which is necessary to stabilize to reach accuracy in testing.

Place the part to be tested in precise antigravity test position.

If the test movement is used it should be performed with constant speed through the full range of motion.

Apply the pressure directly opposite the line of pull of the muscle segment being tested. The pressure should be uniform and applied gradually.

Use a long lever whenever possible but not over two joints and if the muscles do not provide sufficient fixation use a short lever instead.

During muscle strength test, weakness must be distinguished from restriction of range of motion. Frequently a muscle cannot complete the normal range of motion. It may be that the muscle is too weak to complete the movement or it may be that the range of motion is restricted because of shortness of the muscle, capsule or ligament. The examiner should passively carry the part through the range of motion to determine whether any restriction exists. If no restriction is present then failure by the subject to hold the test position may be interpreted as weakness unless joint or tendon laxity is present.

The grading system for evaluation of muscle strength includes six grades. Gone - no contraction, Trace - muscle can be felt to tighten but cannot produce movement, Poor - produces movement with gravity eliminated (no function against gravity), Fair - can move against gravity, Good - can raise the part against outside resistance, Normal - can overcome a greater amount of resistance than a Good muscle. (4)

2.6.11. Muscle Length test

The purpose of assessment of muscle length test is to determine whether the ROM occurring in the joint is normal, limited or excessive by the intrinsic joint structures or by the muscles crossing joint.

Muscles have an important role in supporting and moving the skeletal structures. A muscle has to be short enough to provide stability of a joint and long enough to allow normal mobility.

Muscles that are excessive in length are usually weak and allow adaptive shortening of opposing muscles.

Muscle shortness refers to a situation, in which the muscle limits ROM. (4), (6)

2.6.12. Basic Movement Pattern

The concept of basic movement pattern examination is to evaluate the quality of movements and the sequence of muscle activation. The principles to demonstrate this examination are, slow movement as a high level of coordination is needed, the therapist shouldn't guide or correct any movement during the active phase and no contact should be performed, as it will result to facilitate the muscles. (6)

2.6.13. Soft Tissue examination

A small area of skin can be examined by stretching it between the fingertips, a larger area is examined between the thumbs and the palms of the hands, always taking up the slack until the point where the barrier is engaged and always comparing one side with the other.

To examine subcutaneous connective tissue, including that in scar tissue and shortened muscles, should create a fold and stretch it until the barrier is reached.

In examining fascias, the most useful characteristic to look for is their mobility against the underlying layer, that is mobility of the subcutaneous layer against the muscle and the muscle against the bone. (3)

2.6.14. Joint Play examination

By examining and comparing the joint play movements between the two sides, distinguished whether there is blockage or not in the target joint.

The examination can begin with palpation following by the springing test. (3)

2.6.15. Neurologic examination

This examination is diagnosing the peripheral nerve compression or lesion. Neurological examination of the lower extremities involves examining of the different dermatomes, myotomes and deep tendon reflexes.

A reduction motor impulses along a nerve, a reduction of the sensory input and a reduction in the deep tendon reflexes indicates a peripheral nerve lesion or compression. (2)

2.6.16. Special Tests

2.6.16.1. Romberg test I, II, III

Is balance test with closed eyes that to achieve it, the patient requires visual confirmation of position, non-visual confirmation of position (including proprioceptive and vestibular input) and a normally functional cerebellum.

The following two tests can examining in patients after long time of total hip endoprosthesis.

2.6.16.2. Trendelenburg sign

With 90° flexion of the knee and hip joint we evaluate the lateral pelvic musculature, the shift of the pelvis, the drop of the pelvis and lateroflexion of the trunk.

2.6.16.3. Single-leg stance test

Testing, with open and closed eyes, the natural standing on one leg for 10 seconds. During the test we are observing on the standing (supporting) leg the overall stability and the segmental stability. (29)

2.7. Rehabilitation of long-term outcomes after total hip endoprosthesis

A long time after total hip endoprosthesis, the success of the surgery will depend in large measure on how well patient follows his/her orthopaedic surgeon's instructions regarding home care. Improper or no exercise causes other problems and pain requiring proper treatment to improve.

A comprehensive rehabilitation program for this situation has goals such as to reduce pain and inflammation, correct soft tissue inflexibilities, and improve muscle strength deficits and imbalances. Another important function of rehabilitation is education and training for posture, body mechanics and proprioception with the goal of maintaining the spine in the most optimal biomechanical position during activity.

Rehabilitation includes three stages: acute, recovery and maintenance, however, these phases are not time dependent and tend to overlap. (24)

2.7.1. Acute Phase of Rehabilitation

Goals: decrease the signs and symptoms like pain, swelling, stiffness and other clinical findings.

- Positions of comfort
- Proper body mechanics for movement including position change
- Performance of ADLs like dressing, bathing, toileting, diving and lifting
- Strengthening with stationary bicycle and inclined treadmill
- Aquatic rehabilitation which attenuate pain, allows near-normal ROM and strengthening

Modalities:

- Cryotherapy with ice for maximum time 30 minutes to decrease muscle spasticity, improve flexibility and function and decrease inflammation
- Heat therapy with heat packs for 20 to 30 minutes to decrease spasm and pain and improving flexibility

- Ultrasound for 5 to 10 minutes with intensity of 1.0 - 4.0 W/cm² and form of deep heat therapy, providing therapeutic benefit to tendon, ligament, joint capsule and even bone.
- Electrotherapy use TENS with low frequency stimulation <10 Hz for 20 to 30 minutes to increase circulation, relief pain and modulate the sensation

2.7.2. Recovery Phase of Rehabilitation

Goals: regain local flexibility, proprioception and strengthening

- Dynamic stabilization exercises to improve muscles activity and endurance, restore coordination and position sense, increase lumbar mobility and train balance
- Active exercises improving hip ROM with light terminal stretching
- Stretching exercises to correct muscles tightness
- Gait training

2.7.3. Maintenance Phase of Rehabilitation

Goals: resolve the patient's residual biomechanical deficits and any subclinical adaptations.

- Eccentric muscular strengthening
- Power and endurance exercise
- Gait training

(24), (25)

3. Special Part (Case Study)

3.1. Methodology

The clinical practice took place at Rehabilitační klinika Malvazinky. The practice was for two weeks from 12th of January 2015 until 23rd of January 2015. It was an eight hours timetable daily with a total of eighty hours for the whole two weeks practice.

During my clinical practice I was under the supervision of Mgr. Hanka Zemlerová. The diagnosis of my patient was a total hip endoprosthesis. I had seven sessions with my patient scheduled on different times, starting from 13th of January where I performed the initial kinesiology examinations and from 14th of January we had the first therapy session . The final kinesiology examinations were performed during our last physiotherapeutic session on 26th of January because my patient was sick the last two days before I finished my practice and I went one day extra of the next week.

The physiotherapeutic sessions took place in the individual therapy rooms as well at the gym room. Mainly I used my hands for the examinations and therapy. In addition, the instruments that I used for the examinations were scales, goniometer, meter and neurologic hammer. Moreover during the therapeutic procedures I used the following instruments, overball, bosu ball, thera-band wooden balance board and balance hedgehog.

I would like also to mention that my patient and I signed an acquiescence form. In addition my clinical practice was approved from the Ethics Committee of the Faculty of Physical Education and Sport at Charles University, with the approval number 026/2015. Moreover there is a copy of this form included in supplement of my thesis.

3.2. Anamnesis

Examined person: L. H (Female)

Year of birth: 1938

Diagnosis: Total Hip Endoprosthesis (left side)

Code: Z96.6

3.2.1. Status presents

Height: 1.62 cm

Weight: 67 kg

BMI: 25.5

Pain level: 2/10 when standing for long time and walking long distances without using crutches, in scale from 1 as minimum to 10 as maximum.

I saw the patient at Rehabilitation Clinical Malvazinky 9 days after she came as inpatient. After 3 years of the surgery of total hip endoprosthesis, she decided to come as inpatient at Rehabilitation Clinical Malvazinky to regain her balance and walking unassisted.

When she first came to the rehabilitation room where I was, she was walking with crutches. She undressed and lied on treatment bed by herself without any difficulties. I noticed the scar after her surgery, on lateral side of left leg and was about 15cm long. At the area where the scar is, the muscles there seemed to be atrophic.

She told me that she had no any pain on hip at the moment but when she is standing or walking for a long time she feels her left leg tired and quite painful. Also she was having low back pain which starts from lumbar spine until buttocks on both sides but most of pain was in right side of her back.

3.2.2. History

The patient operated for total hip endoprosthesis on January of 2012 because of her arthrosis that it was getting worse in time. She had some previous rehabilitation as she was hospitalization and for short time as outpatient but rehabilitation did not help her a lot. For 2 years she used to walk with the help of crutches for some days and supporting on them resulting to lose the most of her balance while walking without crutches. She has also vertebral algic syndrome and osteoporosis.

At the beginning of January of 2015, the patient visited a doctor at Rehabilitation Clinical Malvazinky and after some doctor's examinations and X-Rays, she came as inpatient for 1 month to regain her balance, gait and decrease the low back pain. During hospitalization she is doing her everyday physiotherapy treatment and swimming program in group.

3.2.3. Family Anamnesis

No any serious problem with someone of her family.

3.2.4. Operation Anamnesis

The patient had also operation of gallbladder in 2009.

3.2.5. Medications

No use of any medications at this time.

3.2.6. Allergies

No any allergies.

3.2.7. Social Anamnesis

She lives with her husband and her son in a house with stairs.

3.2.8. Occupation Anamnesis

She was working in an office as secretary. Now she is in retirement.

3.2.9. Abuses

She is not smoking but she occasionally drinks alcohol.

3.2.10. Hobbies

She was athletic person when she was younger. At this time she likes swimming.

3.2.11. Previous Injuries

No any previous injuries.

3.2.12. Prior rehabilitation

She had previous rehabilitation after surgery of total hip endoprosthesis before three years for recovery the range of motion of her operated hip, some strengthening and gait treatment.

3.2.13. Excerpt from patient's health care file

The patient had only some x-rays from the doctor. X-rays of thoracic and lumbar spine showed scoliosis S type with right rotation of thoracic spine and left rotation of lumbar spine. Lordosis of lumbar spine with L3 vertebrae on maximum lordosis. Spondylosis and spondyloarthritis also present. Moreover, L1 to L3 vertebrae showed with biconcave compressed deformity.

Results of hip joints X-rays, showed right coxarthrosis and satisfactory position of left hip which is after endoprosthesis, without any release.

3.2.14. Indication of rehabilitation

- Improve balance
- Strengthening of lower extremities
- Decrease pain
- Sensomotoric training
- Gait training

3.2.15. Differential Diagnosis

The patient feels pain on her lower back and buttocks. It is not severe pain but it limits her movements of the trunk and her daily activities. The pain probably arises from instability and muscle imbalance between the areas of hips, pelvis and lower trunk muscles. This pain and symptoms are possible to result from herniation or vertebra-visceral syndrome.

3.3. Initial Kinesiology Examination

Examinations were performed on Tuesday 13/01/2015

3.3.1. Posture Evaluation in standing (without crutches)

Posterior view

Feet: 3cm distance between feet, slight out-toeing

Lower extremities: Knock-knees

Hip joints: Left slightly medially rotated

Pelvis: Lateral tilt, higher on right side

Thoracic and Lumbar Spines: Slight thoracolumbar curve convex toward the left

Scapulae: Right scapula higher than left

Shoulder joints: Both sides slight medially rotated

Shoulder: Left lower

Cervical Spine: Straight

Head: Neutral position

According to my notes for the patient's posterior view, she has abnormal distance between her feet (normal distance is equal to one foot) and slightly out-toeing of both feet, more in right foot. She has also valcosity of both knees, as I saw the knock-knees and the position of her lower extremities. The left, operated, leg has slightly medial rotation of hip, and the pelvis appears to be slightly higher on right side.

Right scapula and shoulder are higher than the left side, with slight medial rotation of both shoulder joints and bigger thoracobrachial triangle on her left side.

Her cervical spine is straight and neutral position of head without tilted or rotation.

Side view (right)

Ankle joints: Slightly dorsal flexion of right ankle joint

Knee joints: Right knee joint not in full extension

Pelvis: Posterior tilt

Lumbar Spine: Flexion (flattening) of the lower lumbar area

Thoracic Spine: Increased flexion

Cervical Spine: Slightly extended

Head: Forward

In right side view of patient's posture I noticed that, due to the not full extension of her right knee, results the slight dorsal flexion of ankle joint. Also, the posterior tilt of her pelvis creates more flat buttocks and the flattening of the lumbar spine.

Furthermore, an increased flexion of the thoracic spine, makes her scapulas protracted. There is also elevation of her right shoulder and flexion of the elbow of right arm.

The slightly extended cervical spine shows the elongation and weak upper back extensors and neck flexors with result of forward head.

Side view (left)

Ankle joints: Slightly dorsal flexion of left ankle joint

Knee joints: Left knee joint not in full extension

Pelvis: Posterior tilt, right rotated

Lumbar Spine: Flexion (flattening) of the lower lumbar area

Thoracic Spine: Increased flexion

Cervical Spine: Slightly extended

Head: Forward

The left side view of patient's posture is almost the same with the right side. Not full extension of her left knee results the slight dorsal flexion of ankle joint. Also, the posterior tilt of her pelvis creates more flat buttocks and the flattening of the lumbar spine.

Furthermore, an increased flexion of the thoracic spine, makes her scapulas protracted. There is also elevation of her left shoulder and flexion of the elbow of left arm.

The slightly extended cervical spine shows the elongation and weak upper back extensors and neck flexors with result of forward head. Her whole body has clockwise rotation.

Frontal view

Feet: 3cm distance between feet, slight out-toeing

Knees: Knock-knees

Pelvis: Lateral tilt, higher on right side

Trunk: Lateral tilt to the left

Shoulder: Left lower than right, medial rotation of both shoulder joints

Head: Neutral position

The frontal view of the patient is similar to the posterior view with abnormal distance of feet and slight out toeing, knock knees that result the valgus of the knees.

The lateral tilt of the pelvis cause the trunk shifting to the left side also the umbilicus is shifting to the left.

Shoulders are not on the same level due to the whole body tilting and bad posture. Head in neutral position without tilted or rotation.

3.3.2. Dynamic test

Maximal extension of spine: The patient expressed for low back pain during extension of the spine and the restriction of the ROM was observed because she stopped moving just she felt pain.

Maximal lateral flexion of spine: It was difficult for the patient to provide the lateral flexion in left and right side because she was feeling pain on low back and stretching of quadratus lumborum muscle during the movement in both sides.

Maximal flexion of spine: Her back was not curved but straight during flexion of spine and there was asymmetry on paravertebral muscles, right side was more prominent. She was feeling again pain of her lower back and she had restricted ROM, as she was not able to touch the floor (about 15 cm from her longer finger to the floor).

3.3.3. Gait Examination

When observing her casual gait as she walks into the room, I saw first her gait with crutches. She had a slow balanced gait, without a risk of falling. She was placing more weight on her right leg, which is the healthy one, and her left leg seemed to having a lighter touch on the floor. She was bending more her left knee during walking and flexed her right hip. Also she was lifting for a slight her left side of pelvis, resulting the shifting to the right side of her body during walking.

Then I asked the patient if she is able to walk through the room without any crutches. Her gait was slight faster than before with crutches, but without crutches was very unstable. She was using the same way of walking as before with the flexion of left knee and hip more than the right leg and elevation of left side of her pelvis. She was afraid to not tire her left leg by placing a lot of body weight on it during walking. She was walking with bigger distance of steps than with crutches and she was not able to walk in a straight line. Her trunk was moving more to the right side and her arms more in abduction with flexion and extension trying to keep a balance.

The backward walking without crutches was almost impossible because the patient was very unstable. She was turning her head to see backward and she had the feeling of falling so she always stops and starts again. She was not able to walk a long distance in a straight line.

Walking on tip toes was not possible for the patient without my hands support.

3.3.4. Weight bearing on two scales

Total weight: 67kg

Weight of left side: 32kg

Weight of right side: 35kg

The difference is not bigger than 5kg (10% of body weight). So, the result is normal.

3.3.5. Anthropometric Measurements

Height (in standing position): 1.62 m

Height (in sitting position): 75 cm

Length measurement

Measured	Left	Right
Anatomical Legth	87 cm	88 cm
Functional Length	93cm superior anterior iliac spine, 90cm umbilicus	94cm superior anterior iliac spine, 91cm umbilicus
Thigh	45 cm	46 cm
Middle Leg	42 cm	42 cm
Foot	23 cm	23 cm

Table 1: lower extremities initial length measurement

Circumference measurement

Measured	Left	Right
Thigh (m.guadriceps)	49 cm	50cm
Thigh (hypotrophy of vastus medialis)	45 cm	46 cm
Knee joint	41 cm	42 cm
Calf	37 cm	37 cm
Ankle	35 cm	35 cm
Foot	31 cm	31 cm

Table 2: lower extremities initial circumference measurement

Measured	Left	Right
Upper Arm	29 cm	29 cm
Forearm	25 cm	26 cm

Table 3: upper extremities initial circumference measurement

Other Anthropometric Measurements			
Thorax-Sternum	95 cm		
Breath in	99 cm	98 cm	98 cm
Breath out	94 cm	94 cm	94 cm
Waist	94 cm		
Hips	103 cm		

Table 4: initial circumference of thorax-sternum, waist and hips

3.3.6. Range of Motion (ROM) Examination (according to Kendall)

Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion with extended knee	80°	85°	85°	90°
Flexion with flexed knee	100°	115°	110°	120°
Extension	5°	10°	10°	10°
Abduction	40°	45°	45°	45°
Adduction	10°	10°	10°	10°
External Rotation	35°	45°	40°	45°
Internal Rotation	25°	30°	30°	30°

Table 5: initial examination of the ROM of Hip joint

Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion	120°	120°	120°	120°
Extension	0°	0°	0°	0°

Table 6: initial examination of the ROM of the Knee joint

Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Dorsal Flexion	20 ⁰	20 ⁰	15 ⁰	15 ⁰
Plantar Flexion	45 ⁰	45 ⁰	45 ⁰	45 ⁰
Inversion	30 ⁰	30 ⁰	30 ⁰	30 ⁰
Eversion	20 ⁰	20 ⁰	20 ⁰	20 ⁰

Table 7: initial examination of the ROM of the Ankle joint

3.3.7. Muscle strength test (according to Kendall)

Tested muscle	Right (grades)	Left (grades)
Gluteus maximus	4	4
Gluteus medius	4	4
Gluteus minimus	4	4
Lateral rotators of hip joint (Piriformis, quadratus femoris, obturator internus, obturator externus, gemellus superior, gemellus inferior)	5	4
Medial rotators	5	4
Hip adductors (Pectineus, adductor magnus, gracilis, adductor brevis, adductor longus)	4+	4
Tensor fasciae latae	4	4
Sartorius	4	4
Iliopsoas (Psoas major, psoas minor, iliacus)	5	4
Quadriceps femoris (Rectus femoris, vastus lateralis, v.intermedius, v.medialis)	5	5
Biceps femoris	5	4
Semimembranosus	5	4+

Semitendinosus	4+	4+
Popliteus	5	5
Plantar flexors (Gastrocnemius, plantaris)	5	4
Soleus	5	4+
Peroneus longus and brevis	5	4
Tibialis posterior	5	4
Tibialis anterior	5	4
Extensor digitorum longus and brevis	4+	4+
Flexor digitorum longus	5	5
Flexor digitorum brevis	5	5
Extensor hallucis longus and brevis	4+	4+
Flexor hallucis longus and brevis	4+	4+

Table 8: initial muscle strength test of Lower extremities

3.3.8. Muscle Length test (according to Janda)

Examined muscle	Left (grades)	Right (grades)
Trapezius	0	0
Pectoralis major	0	0
Pectoralis minor	1	1
Quadratus lumborum	1	1
Iliopsoas	1	0
Hip adductors	0	0
Hamstrings	0	0
Soleus	0	0

Table 9: initial muscle length test

3.3.9. Pelvis examination

I palpated the pelvis of the patient. Her left anterior and posterior superior iliac spine were lower than right side. Also her anterior and posterior iliac crests on the left side were lower than her right side. So, her pelvis had lateral tilt to the left.

3.3.10. Muscle tone Examination (Palpation)

During the palpation of the muscles I found some muscles which were hypotonic like abdominal muscles (rectus abdominis, external obliques) both sides, adductors on both sides and gluteus medius on left side which is the operated leg. Other muscles were in normal tone like iliopsoas on right side, quadriceps femoris on both sides, hamstrings and soleus muscles on both sides. Hypertonic muscles were gluteus maximus on both sides, gluteus medius on right side, lower paravertebral muscles on both sides and iliopsoas on left side.

3.3.11. Soft tissue Examination (according to Lewit)

In prone lying position I checked the fascias of cervicothoracic area in cranial direction and thoracolumbar area in caudal direction on both sides of back. The fascias were more restricted in both directions on right side than the left side.

3.3.12. Joint Play Examination (according to Lewit)

In supine lying position I checked the joint play of:

Blocked metatarsophalangeal joints in dorsoplantar and laterolateral direction in both legs

Free Lisfranc's joint in dorsoplantar direction in both legs

Free Chopart's joint in dorsoplantar direction in both legs

Free talocrural joint in distal direction in both legs

Free tibiofibular joint in distal and ventral direction in both legs

Free patella in craniocaudal and laterolateral direction in both legs

Blocked metacarpophalangeal joints in dorso-palmar direction in both hands

Blocked carpometacarpal joints in dorso-palmar and laterolateral directions in both hands

Free wrist joint in dorsal and palmar directions in both arms

Blocked elbow joint in medial and lateral directions in both arms

3.3.13. Neurological examination

3.3.13.1. Sensation of some areas by light touching

Shoulders

she has the same sensation in both shoulders

Inner and outer aspects of forearm

she has the same sensation in both sides

Thumbs and little fingers

she has the same sensation in both sides

Front of both thighs

she has the same sensation in both thighs

Medial and lateral aspect of both calves

she has the same sensation in both sides

Little toes

she has the same sensation in both sides

3.3.13.2. Deep tendon reflexes

Biceps

Right side= grade 2 (normal response) , Left side= grade 2 (normal response)

Triceps

Right side= grade 2 (normal response) , Left side= grade 2 (normal response)

Flexors

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

Finger jerk

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

Knee

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

Achilles tendon

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

3.3.13.3. Kinesthesia

I grasped the patient's big toe and hold it away from the others toes to avoid friction. I showed the patient which movement is up and which is down. Then I asked the patient to close eyes and identify the direction I move the toe.

The patient was able to identify the direction I was moving her toe in both legs.

3.3.14. Breathing examination

In supine lying position I checked the breathing pattern by observation and placing my hands on patient's abdominal muscles and both sides of lower thorax. The movement was lateroventral and symmetrical in both sides.

3.3.15. Other special tests

3.3.15.1. Diaphragm Test: In sitting position with upright posture of the patient's spine I palpated with my hands on dorsolateral part, underneath the lower ribs and slightly against abdominal muscles. The patient asked to resist with the lower part of the chest expanding under my hands while maintain the spine to an erect posture. The patient was able to activate muscles against resistance with small force and during activation, the chest was not expanding laterally but mostly cranially.

3.3.15.2. Romberg Test I, II, III: negative

3.3.15.3. Trendelenburg Test: standing on right leg-negative
standing on left leg-positive

3.3.16. Conclusion of initial kinesiology examination

According to my initial kinesiology examination, starting from the posture evaluation of my patient, she was able to stand without crutches but she had an incorrect posture with abnormal distance between her feet, valcosity of both knees, lateral tilt of pelvis and trunk on left side, posterior tilt of pelvis, flat lumbar spine and kyphotic thoracic spine.

During dynamic test of spine she was not able to fully cover all of the motions of her spine due to pain on lumbar spine.

Her gait was based mostly on crutches resulting to lose the stability of her body during walking without crutches and an abnormal gait pattern.

When I checked the weight bearing on two scales of my patient, I found out that the result of weight in both legs was almost the same, normal result, but still bigger on healthy leg.

Moreover, I noticed that in length measurement was missing 1cm of the left leg to be equal with the right leg. The result of 1cm difference is usually physiological but in this situation it may caused from the total hip endoprosthesis surgery.

The ROM in all joints was good also the strength of most of the muscles. Some other muscles around the hip joints were quite weak, like gluteus maximus, gluteus medius, hip adductors and is important to strength them because are useful in the stability of hip and pelvis.

Short iliopsoas muscle present on left leg, hypertonic gluteus maximus and lower paravertebral muscles in both sides and hypotonic abdominal muscles that all of them are part of the core stabilization system and must be improved.

Restricted fascias in thoracolumbar area causes also limitations of movements and pain on the patient in compination with the rest abnormalities.

Diaphragm test was provided to check stabilization of the trunk and as I found from the results of the test, the patient was not able to do it correctly means that she could not activate her core stabilization system due to muscle imbalance.

Joint play, neurologic and breathing examinations were clear without any problem.

Some of the results that I found during initial kinesiology examination are normally existent, as the patient is an old woman and her body has changed over the years.

For example, part of her bad posture is due to erderly and another part is due to the hip surgery she had before three years and the rehabilitaion that did not help her. Arthritis and osteoporosis are also related with the patient's pain but the main cause is the deformities that

resulted after total hip endoprosthesis such as scoliosis, kyphosis of the thoracic spine and lordosis of the lumbar spine, lumbar vertebrae compression, the tilt of the pelvis, bad loading and antalgic gait leading to the low back pain.

The patient was difficult mostly during walking and in activities that need to move her trunk into deep flexion, extension and lateral flexion in both sides.

During therapy sessions we will exercise to improve all of the abnormalities I found on initial kinesiology examination because all together constitute the main purpose of the patient, to gain her balance and walk without assistive devices.

3.4. Short term and long term rehabilitation plan

3.4.1. Short-term physiotherapy plan

Decrease pain

Stretching of cervicothoracic and thoracolumbar fascias in cranial and caudal directions

Stretching of short m.iliopsoas of left leg

Strengthening of weak m.gluteus maximus, m.gluteus medius, m.adductors and m.tensor fascia latae

Relax hypertonic m.gluteus maximus, m.gluteus medius and lower paravertebral muscles

Activate core stabilization system

Improve balance

Gait training without crutches

3.4.2. Long-term physiotherapy plan

Improve core stabilization system

Correct posture during standing position

Improve balance of gait without crutches

Maintain and improve the fascias in cranial and caudal directions, lengthening of m.iliopsoas of left leg, the strength of the m.gluteus maximus, m.gluteus medius, m.adductors, m.tensor fascia latae and relaxation of m.gluteus maximus, m.gluteus medius and lower paravertebral muscles

3.5. Therapy Progress

Date: Wednesday 14.01.15

Therapy Session NO:1

Time: 11:00-11:30

Status Present

Subjective: The patient does not express of any pain at the beginning of the session

Objective: The patient came in with axillary crutches, loading the most of her weight on them and on right leg.

Goal of today's therapy unit

- Strengthening of weak m.adductors and m.abductors
- Stretching of short m.iliopsoas
- Activation of intra-abdominal pressure with m. abdominal, pelvic floor muscles, lower back muscles and diaphragm
- Improve core stability
- Uprighting the spine

Execution

The therapy started with the patient lying in supine position. I placed the overball between patient's thighs to strength the adductors in both legs with isometric contraction exercise. With bend knees, the patient was pressing the overball.

Isometric contraction exercise also done, for abductors with the patient's legs extended on the treated table and holding against my hand resistance placed on lateral side of the patient's thigh. First on one leg and then on the other.

The therapy continued with stretching of m.iliopsoas on left side, in prone lying position with flexion of the knee.

Then, in supine lying position and legs on gymnastic ball with 90° flexion of hips and knees, I instructed the patient to lift for slight, first the right leg, from the ball and concentrate on her abdominal, back and pelvis areas to hold the spine and pelvis in straight position. I placed also one hand on patient's abdominal area and asked her to breath under my hand keeping the position for 20 seconds. Then change leg and repeat the exercise for 3 times each

leg. With this way, intra-abdominal pressure was present due to activation of m. abdominal, pelvic floor muscles, lower back muscles and diaphragm.

Bridging exercise to improve the core stabilization system of the patient. In supine lying position with bended knees, the patient was lifting her pelvis from the treated table, supporting with her hands placed sideways of her body. Repeat it for 10 times.

Last exercise of the day, was provided by my supervisor. An exercise for activation of paravertebral muscles and uprighting the spine, with the patient in prone lying position and feet out of the end of treated table. My supervisor asked the patient to make dorsal flexion of both ankles so that her toes touch the table. Then, placing one hand on lumbar area of patient's back to localise the breathing, the activation of paravertebral muscles and uprighting of spine was present.

Results

Objective: No any obvious change in the status of the patient after the today's therapy, but during the therapy, stretching exercise for m.iliopsoas had slightly flexion movement of the knee increased under passive stretching.

After physiotherapy session, at 12:00 o' clock, the patient went to swimming program with group and I attended the class to see what type of exercises they are doing. For 30 minutes they are exercising in walking forward, backward and sideward, lifting one leg up with extended knee and then back and change leg, lifting one leg up with bended knee and change leg, make circles of their legs and try to balance standing on a board under the water. Then they are doing some push ups holding the swimming pool wall and they also exercise their arms using boards of the swimming pool and acting different movements.

Date: Thursday 15.01.15

Therapy Session NO:2

Time: 8:30-9:10

Status Present

Subjective: The patient told me that she was feeling the same like the previous day, no any special pain and she is positive for the results of the therapy.

Objective: Today the patient came with one axillary crutch holding it on her left arm. She was trying to load her weight the same in both sides but she was quite unstable.

Goal of today's therapy unit

- Improve core stability
- Improve balance
- Correct patient's posture
- Walking training without crutches
- Strengthening of flexors, extensors, abductors and adductors muscles of legs

Execution

The today's therapy performed at the gym of the Rehabilitation Clinic.

Starting with an exercise to improve the core stabilization system and balance was done in a sitting position on a gymnastic ball with 90° flexion of the patient's legs. I instructed my patient to concentrate in abdominal, paravertebral and pelvic floor muscles and try to keep her balance while lifting one leg up from the floor for 5 seconds. Change leg and repeat the exercise for 10 times.

Second exercise with the same goal was again in sitting position on a gymnastic ball with 90° flexion of patient's legs and concentrate again on abdominal, paravertebral and pelvic floor muscles. I was standing back of my patient and giving to her some resistance in all directions while she was trying to hold her position against my resistance.

We continued with correcting posture and improve balance of patient. I used the bosu ball to first show the exercises to the patient and then with my support I helped my patient to perform them. First exercise was done by standing with both legs on the bosu ball and try to balance. I instructed my patient to flex her knees for slight while I was correcting her posture of pelvis, spine and head to be in a straight position.

During the exercise I was standing in front of my patient, to have my support when she was feeling unbalanced and she wanted to hold somewhere.

Then we continued the therapy by walking training. Without crutches and with my hands supporting, the patient was walking from heel to toe with one leg back to the other in a straight line. We used slow speed of walking and more stable steps.

Also sideways walking without my support was performed by my patient.

Last exercise for the today's therapy was provided with patient in standing position and hold on a chair for balance. Strength her leg muscles during she was exercising with

thera-band in all directions of hip (flexion, extension, abduction and adduction) for 5 minutes each leg.

Results

Objective: Some exercises successfully provided by my patient and in some other she needed my support. She managed to activate the core stabilization system and keep her position balanced on gymnastic ball during exercise. The most difficult for her is to stand on the bosu ball because is an unstable surface and she needs some time to load her weight correctly and provide the exercise with my support.

After physiotherapy session, at 12:00 o' clock, the patient went to swimming program with group for 30 minutes. They are exercising in walking forward, backward and sideward, lifting one leg up with extended knee and then back and change leg, lifting one leg up with bended knee and change leg, make circles of their legs and try to balance standing on a board under the water. Then they are doing some push ups holding the swimming pool wall and they also exercise their arms using boards of the swimming pool and acting different movements.

Date: Friday 16.01.15

Therapy Session NO:3

Time: 10:45-11:15

Status Present

Subjective: The patient today expressed for low back pain that reaches the buttocks.

Objective: During checking the fascias of cervicothoracic area in cranial direction and thoracolumbar area in caudal direction, no enough elasticity was present. While palpating on the patient's back muscles of the body I found some trigger points on the low back muscles and gluteus maximus muscle of the right side. Also stiff and hypertonic the lower paravertebral muscles in both sides and gluteus maximus muscles, more in right side.

Goal of today's therapy unit

- Improve the elasticity of cervicothoracic and thoracolumbar fascias
- Break down the trigger points
- Relax the lower paravertebral muscles and m.gluteus maximus
- Stretching of short m.iliopsoas on left side
- Uprighting the spine

Execution

The today's therapy includes some relaxation techniques of the patient's low back and buttocks because she was feeling slight pain and stretching on this areas.

Firstly I tried to stretch the fascias of cervicothoracic and thoracolumbar area in cranial and caudal directions of both sides, using the breathing and repeat it until releasing is present.

Then my supervisor provided localised pressure with her fingers on the lower back muscles and buttocks area on m.gluteus maximus to the right side to break down the trigger points. After instructions of my supervisor I continued the therapy followed by relaxing massage on lower paravertebral muscles and m.gluteus maximus on both sides.

Stretching of m.iliopsoas on left side was performed too, having the patient in prone lying position with flexion of the knee.

At the end of the session, my supervisor gives an exercise to the patient for uprighthing the spine, on right side lying position while the left leg which is the operated was resting on a pillow, between both bended knees. Right arm was bended under the patient's head and left arm was resting on the left side of her body. My supervisor corrected patient's position and placed her second and third fingers of one hand on the patient's lower back, where the maximum lordosis was present, instructing the patient to breathing under her fingers and activate the lower back muscles. With this way, there was a movement against lordosis of the lumbar spine and correction of the spine in a more uprighthing position.

Results

Objective: I checked again at the end of the therapy the trigger points and muscle tone of lumbar and buttocks areas. They were in a better condition and more relaxed than on the beginning of therapy. The best effect was in fascias which regain some of the elasticity.

After physiotherapy session, at 12:00 o' clock, the patient went to swimming program with group for 30 minutes. They are exercising in walking forward, backward and sideward, lifting one leg up with extended knee and then back and change leg, lifting one leg up with bended knee and change leg, make circles of their legs and try to balance standing on a board under the water. Then they are doing some push ups holding the swimming pool wall and they also exercise their arms using boards of the swimming pool and acting different movements.

Date: Monday 19.01.15

Therapy Session NO:4

Time: 14:00-14:30

Status Present

Subjective: The patient feels very well today.

Objective: She came in physiotherapeutic room without crutches. Every day she is improving her gait and the result is obvious. She was trying a lot also by herself during the weekend to walk bigger distances without crutches and she does not need the crutches anymore.

Goal of today's therapy unit

- Activate deep stabilization system and increase hip joint stability
- Improve balance during standing position
- Correct gait without crutches
- Strengthening of flexors, extensors, abductors and adductors muscles of legs
- Stretching of short m.iliopsoas on left side

Execution

The patient is told to lie to the treated table, first on the right side and my supervisor provided to the patient an exercise from DNS, of reflex turning focusing in an open and close kinematic chains. With bended knees and ipsilateral shoulder in 90° flexion, with forearm perpendicular to the table, the patient instructed to support with ipsilateral elbow and knee and lift her contralateral knee upwards for some cm, holding her ankles together. Trying to activate the deep stabilization system, repeat the exercise 3 times and then change side.

I showed some balance exercises to the patient and we practise them together. Standing on a balance board with both legs and try to balance. I instructed my patient to flex her knees for slight while I was correcting her posture of pelvis, spine and head to be in a straight position. Then we used the balance hedgehog to step with each leg on a different and keep her position on them without losing the balance.

Then we continued with gait training. I instructed the patient to walk in a straight line from heel to toe, in sideways and at the end I explain to her the 3 points that we have to use during walking and I showed to her the correct way of stepping. She also exercise the correct way of normal walking while I was correcting her pelvis, trunk, arms and head during walking.

Strengthening was provided with patient in standing position and hold on a chair for balance. Strength her leg muscles during she was exercising with thera-band in all directions of hip (flexion, extension, abduction and adduction) for 5 minutes each leg.

We last stretched the iliopsoas muscle of the left side by showing to my patient how to do it by herself and then she provided the exercise with my help and corrections.

With left knee touching the floor and right leg in 90° flexion of hip and knee so the lower leg is perpendicular to the floor, the patient is also holding with right hand to the treated table which is on her right side. Patient is told to move slightly forward, bending her right knee more than 90° and keeping her pelvis, trunk and head in straight and upright position. Stay in this position for 5 seconds, go back and repeat it 5 times.

Results

Objective: The therapy today was very helpful for the patient. She is not very stable yet when she is standing on devices and during gait training she needed some time to find the way of correct walking but she was finally walking well without my support.

Before the today's therapy, at 12:00 o' clock, the patient went to swimming program with group for 30 minutes. They are exercising in walking forward, backward and sideward, lifting one leg up with extended knee and then back and change leg, lifting one leg up with bended knee and change leg, make circles of their legs and try to balance standing on a board under the water. Then they are doing some push ups holding the swimming pool wall and they also exercise their arms using boards of the swimming pool and acting different movements.

Date: Tuesday 20.01.15

Therapy Session NO:5

Time: 11:00-11:30

Status Present

Subjective: Patient told me today that she feels very good and more stable.

Objective: The weight bearing of the patient's two legs during walking is better than the previous days. She seems to walk with more stable steps.

Goal of today's therapy unit

- Improve core stabilization system
- Strengthening of weak m.gluteus medius
- Stretching of short m.iliopsoas on left side
- Gait training

Execution

I start the therapy asking the patient to lie in supine position, with gymnastic ball under the 90° flexed legs of patient. I was moving the ball with my hands in left and right directions while the patient was trying to stop the movement of ball using the strength of the deep muscles.

Next exercise, also well for the core stabilization system, was in supine lying position placing her arms on sideways of her body and bend the knees. Provide the bridging exercise by activation of deep muscles and lifting her pelvis up from the treated table, supporting her body to her feet and palms. Repeat the exercise for 10 times.

In right side lying position and supporting her body holding lateral of the treated table, I was giving resistance at the left leg of the patient while she was abduct her leg to strengthen the m.gluteus medius. Then change side lying and strengthen the other leg.

We continued with stretching of iliopsoas muscle as I already showed to my patient how to do it by herself. With left knee touching the floor and right leg in 90° flexion of hip and knee so the lower leg is perpendicular to the floor, the patient is also holding with right hand to the treated table which is on her right side. Patient is told to move slightly forward, bending her right knee more than 90° and keeping her pelvis, trunk and head in straight and upright position. Stay in this position for 5 seconds, go back and repeat it 5 times.

We end the therapy by gait training on the corridor of the therapeutic room, with patient using the 3 points of the feet and me correcting her abnormalities of pelvis, trunk, head and arms during walking.

Results

Objective: The patient is very cooperation and she is providing the exercises with not so much difficulties as at the beginning of the therapy session.

Date: Wednesday 21.01.15

Therapy Session NO:6

Time: 15:15-15:45

Status Present

Subjective: The patient told me that she needs a relax therapy today because she was tired.

Objective: Her balanced and gait improved a lot relative to the beginning of the first therapy session together and this is result after also her own gait exercising in the corridor. Her lower paravertebral and gluteus muscles were in a better condition but still quite stiff.

Goal of today's therapy unit

- Uprighting the spine
- Improve the elasticity of cervicothoracic and thoracolumbar fascias
- Relax the lower paravertebral muscles and m.gluteus maximus
- Stretching of short m.iliopsoas on left side

Execution

The patient is instructed to lie in prone position. My supervisor placed one hand on the cervical area and other hand on lumbosacral area asking the patient to activate the muscles of the lordotic areas under of her hands and try to move the spine in more upright position. Then relax and repeat the exercise for 10 times.

I continued the therapy with stretching of the fascias of cervicothoracic and thoracolumbar area in cranial and caudal directions of both sides, using the breathing and repeat it until releasing is present.

Then I provided relaxing massage on lower paravertebral and m.gluteus maximus in both sides, to relax the tone of the muscles.

We end with the stretching of iliopsoas muscle as I already showed to my patient how to do it by herself. With left knee touching the floor and right leg in 90° flexion of hip and knee so the lower leg is perpendicular to the floor, the patient is also holding with right hand to the treated table which is on her right side. Patient is told to move slightly forward, bending her right knee more than 90° and keeping her pelvis, trunk and head in straight and upright position. Stay in this position for 5 seconds, go back and repeat it 5 times.

Results

Objective: The today's therapy was effective again to the patient with better results because I spent more time to relax the muscles with massage and the patient felt well. Also, the stretching of m.iliopsoas of left side provided easier from the patient.

Date: Thursday 22.01.15 and Friday 23.01.15

The patient was sick and my supervisor suggested to not do therapy to the patient until she feels better.

Date: Monday 26.01.15

Therapy Session NO:7

Time: 15:30-16:00

Status Present

Subjective: The patient is feeling better after her sickness. Today is the first day as outpatient and she is very happy. She told me that she understands the improvement of her balance and her gait and she can stand and walk more time without pain anymore.

Objective: Her spine movements seem to be more free and easily provided, also her lower back muscles are more relaxed. Her gait has improved a lot but she still needs practice on balance.

Goal of today's therapy unit

- Activation of core stabilization system
- Improve balance during standing position
- Uprighting the spine

Execution

My supervisor started the therapy, instructed the patient to lie in supine position with bended knees and lift one leg up with extension of knee, for 10 seconds, activating the abdominals, back and pelvic floor muscles. Repeat this exercise for 10 times each leg.

I continued therapy with sensomotoric training using the wooden balance board to improve patient's balance on unstable surface. I asked the patient to stand on the wooden balance board, bend both knees for slight, correct her spine and head posture as I learned her from the previous therapies and balance on it keeping this position for slight and relax. Repeat it for 10 times.

At the end of the therapy my supervisor provided an exercise for correction the position of the patient's back in right side lying with bended knees. Right arm was bended under the patient's head and left arm was resting on the left side of her body. My supervisor corrected patient's position and placed her second and third fingers of one hand on the patient's lower back, where the maximum lordosis was present, instructing the patient to breathing under her fingers and activate the lower back muscles. With this way, there was a movement against lordosis of the lumbar spine and correction of the spine in a more uprighting position.

Results

Objective: This was the last therapy of the patient with me and I believe that she achieved a big part of her goals. She has improved for quite the balance but she has to keep exercising also for some more strength of her lower extremities.

As outpatient she is going to continue physiotherapy twice a week until she reach and maintain all of her goals.

3.6. Final Kinesiology Examination

Examinations were performed on Monday 26/01/2015

3.6.1. Posture Evaluation in standing (without crutches)

Posterior view

Feet: 5cm distance between feet, slight out-toeing

Lower extremities: Knock-knees

Hip joints: Left slightly medially rotated

Pelvis: Lateral tilt, higher on right side

Thoracic and Lumbar Spines: Straight

Scapulae: Right scapula slight higher

Shoulder joints: Both sides slight medially rotated

Shoulder: Left shoulder slight lower

Cervical Spine: Straight

Head: Neutral position

According to final kinesiologic examination the patient's posterior view improved, while her distance between her feet is 5cm. There is slightly out-toeing of both feet yet and she has also valgus of both knees. The left, operated, leg has slightly medial rotation of hip and the pelvis is still higher on the right side but is more closed to the left side than at the beginning of the therapy sessions.

Right scapula and shoulder are higher but also with not so much difference than on the initial examination. Slight medial rotation of both shoulder joints and almost same thoracobrachial triangle on both side.

Her cervical spine is straight and neutral position of head without tilted or rotation.

Side view (right)

Ankle joints: Slightly dorsal flexion of right ankle joint

Knee joints: Right knee joint not in full extension

Pelvis: Posterior tilt

Lumbar Spine: Flexion (flattening) of the lower lumbar area

Thoracic Spine: Increased flexion

Cervical Spine: Slightly extended

Head: Forward

In right side view of patient's posture there is not full extension of her right knee that results the slight dorsal flexion of ankle joint. Also, the posterior tilt of her pelvis creates more flat buttocks and the flattening of the lumbar spine.

Furthermore, an increased flexion of the thoracic spine, makes her scapulas protracted. There is also elevation of her right shoulder and flexion of the elbow of right arm.

The slightly extended cervical spine shows the elongation and weak upper back extensors and neck flexors with result of forward head.

Side view (left)

Ankle joints: Slightly dorsal flexion of left ankle joint

Knee joints: Left knee joint not in full extension

Pelvis: Posterior tilt, right rotated

Lumbar Spine: Flexion (flattening) of the lower lumbar area

Thoracic Spine: Increased flexion

Cervical Spine: Slightly extended

Head: Forward

The left side view of patient's posture is almost the same with the right side. Not full extension of her left knee results the slight dorsal flexion of ankle joint. Also, the posterior tilt of her pelvis creates more flat buttocks and the flattening of the lumbar spine.

Furthermore, an increased flexion of the thoracic spine, makes her scapulas protracted. There is also elevation of her left shoulder and flexion of the elbow of left arm.

The slightly extended cervical spine shows the elongation and weak upper back extensors and neck flexors with result of forward head. Her whole body has clockwise rotation.

Frontal view

Feet: 5cm distance between feet, slight out-toeing

Knees: Knock-knees

Pelvis: Lateral tilt, higher on right side

Trunk: Slight lateral tilt to the left

Shoulder: Left lower than right, medial rotation of both shoulder joints

Head: Neutral position

The final frontal view of the patient is also quite better than on the initial. Increased of feet distance to 5 cm and slight out toeing, knock knees that result the valgus of the knees.

The lateral tilt of the pelvis is still present while the lateral tilt of the trunk to the left is less than on the initial examination.

Shoulders are also not on the same level but are in a more closed level than before. Head in neutral position without tilted or rotation.

3.6.2. Dynamic test

Maximal extension of spine: The patient provided her maximum spine extension without any restriction or pain.

Maximal lateral flexion of spine: On right side the maximum lateral flexion of the spine was done successfully without restrictions or pain but in left side there was slight limited motion than the right side and again without pain.

Maximal flexion of spine: With more curved back during flexion of spine and without feeling of pain, she managed an increase of ROM and she was closed to touch the floor (about 5 cm from her longer finger to the floor).

3.6.3. Gait Examination

The patient is walking without the help of crutches anymore. Her walking pattern was improved and it is more objective stable.

During walking forward she is able to walk in a straight line with normal speed of gait, means not too slow or too fast stepping, more rhythmic and synchronized. More stable steps from heel to toes and normal flexion and extension of both hips improved. The flexion movement of the left knee she used to do decreased so her gait seems to be smoother now with no elevation of the left side of pelvis.

She sometimes has the right tilt of her trunk during walking because she still uses quite more weight on her healthy side.

Her arms are not in abduction like before the therapy sessions but are moving both in flexion and extension of shoulders.

The backward walking provided again without crutches. The patient was able to walk backward in a small distance without fears of falling or turning her head to see but she was still unstable and she was not walking in a straight line.

Walking on tip toes provided with my hands supporting next to the patient.

3.6.4. Weight bearing on two scales

Total weight: 67kg

Weight of left side: 33kg

Weight of right side: 34kg

The difference is not bigger than 5kg (10% of body weight). So, the result is normal.

3.6.5. Anthropometric Measurements

Height (in standing position): 1.62 m

Height (in sitting position): 75 cm

Length measurement

Measured	Left	Right
Anatomical Length	87 cm	88 cm
Functional Length	93cm superior anterior iliac spine, 90cm umbilicus	94cm superior anterior iliac spine, 91cm umbilicus
Thigh	45 cm	46 cm
Middle Leg	42 cm	42 cm
Foot	23 cm	23 cm

Table 10: lower extremities final length measurement

Circumference measurement

Measured	Left	Right
Thigh (m.guadriceps)	49 cm	50cm
Thigh (hypotrophy of vastus medialis)	45 cm	46 cm
Knee joint	41 cm	42 cm
Calf	37 cm	37 cm
Ankle	35 cm	35 cm
Foot	31 cm	31 cm

Table 11: lower extremities final circumference measurement

Measured	Left	Right
Upper Arm	29 cm	29 cm
Forearm	25 cm	26 cm

Table 12: upper extremities final circumference measurement

Other Anthropometric Measurements			
Thorax-Sternum	95 cm		
Breath in	99 cm	98 cm	98 cm
Breath out	94 cm	94 cm	94 cm
Waist	94 cm		
Hips	103 cm		

Table 13: final circumference of thorax-sternum, waist and hips

3.6.6. Range of Motion (ROM) Examination (according to Kendall)

Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion with extended knee	80°	85°	85°	90°
Flexion with flexed knee	100°	115°	110°	120°
Extension	5°	10°	10°	10°
Abduction	40°	45°	45°	45°
Adduction	10°	10°	10°	10°
External Rotation	35°	45°	40°	45°
Internal Rotation	25°	30°	30°	30°

Table 14: final examination of the ROM of Hip joint

Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion	120°	120°	120°	120°
Extension	0°	0°	0°	0°

Table 15: final examination of the ROM of the Knee joint

Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Dorsal Flexion	20 ⁰	20 ⁰	15 ⁰	15 ⁰
Plantar Flexion	45 ⁰	45 ⁰	45 ⁰	45 ⁰
Inversion	30 ⁰	30 ⁰	30 ⁰	30 ⁰
Eversion	20 ⁰	20 ⁰	20 ⁰	20 ⁰

Table 16: final examination of the ROM of the Ankle joint

3.6.7. Muscle strength test (according to Kendall)

Tested muscle	Right (grades)	Left (grades)
Gluteus maximus	4	4
Gluteus medius	4+	4+
Gluteus minimus	4	4
Lateral rotators of hip joint (Piriformis, quadratus femoris, obturator internus, obturator externus, gemellus superior, gemellus inferior)	5	4
Medial rotators	5	4
Hip adductors (Pectineus, adductor magnus, gracilis, adductor brevis, adductor longus)	4+	4+
Tensor fasciae latae	4	4
Sartorius	4	4
Iliopsoas (Psoas major, psoas minor, iliacus)	5	4
Quadriceps femoris (Rectus femoris, vastus lateralis, v.intermedius, v.medialis)	5	5
Biceps femoris	5	4
Semimembranosus	5	4+

Semitendinosus	4+	4+
Popliteus	5	5
Plantar flexors (Gastrocnemius, plantaris)	5	4
Soleus	5	4+
Peroneus longus and brevis	5	4
Tibialis posterior	5	4
Tibialis anterior	5	4
Extensor digitorum longus and brevis	4+	4+
Flexor digitorum longus	5	5
Flexor digitorum brevis	5	5
Extensor hallucis longus and brevis	4+	4+
Flexor hallucis longus and brevis	4+	4+

Table 17: final muscle strength test of Lower extremities

3.6.8. Muscle Length test (according to Janda)

Examined muscle	Left (grades)	Right (grades)
Trapezius	0	0
Pectoralis major	0	0
Pectoralis minor	1	1
Quadratus lumborum	1	1
Iliopsoas	0	0
Hip adductors	0	0
Hamstrings	0	0
Soleus	0	0

Table 18: final muscle length test

3.6.9. Pelvis examination

I palpated the pelvis of the patient. Her left anterior and posterior superior iliac spine were lower than right side. Also her anterior and posterior iliac crests on the left side were lower than her right side, but on final examination, her pelvis had less lateral tilt to the left.

3.6.10. Muscle tone Examination (Palpation)

During the palpation of the muscles I found some muscles which were hypotonic like abdominal muscles (rectus abdominis, external obliques) both sides, adductors on both sides and gluteus medius on left side which is the operated leg. Other muscles were in normal tone like iliopsoas on right side, quadriceps femoris on both sides, hamstrings and soleus muscles on both sides. Hypertonic muscles in final examination were not present because the gluteus maximus on both sides, gluteus medius on right side lower paravertebral muscles on both sides and iliopsoas on left side relaxed and they are in a normal tone.

3.6.11. Soft tissue Examination (according to Lewit)

In prone lying position I checked the fascias of cervicothoracic area in cranial direction and thoracolumbar area in caudal direction on both sides of back. The fascias were more relaxed in both sides of the body.

3.6.12. Joint Play Examination (according to Lewit)

In supine lying position I checked the joint play of:

Blocked metatarsophalangeal joints in dorsoplantar and laterolateral direction in both legs

Free Lisfranc's joint in dorsoplantar direction in both legs

Free Chopart's joint in dorsoplantar direction in both legs

Free talocrural joint in distal direction in both legs

Free tibiofibular joint in distal and ventral direction in both legs

Free patella in craniocaudal and laterolateral direction in both legs

Blocked metacarpophalangeal joints in dorso-palmar direction in both hands

Blocked carpometacarpal joints in dorso-palmar and laterolateral directions in both hands

Free wrist joint in dorsal and palmar directions in both arms

Blocked elbow joint in medial and lateral directions in both arms

3.6.13. Neurologic examination

3.6.13.1. Sensation of some areas by light touching

Shoulders

she has the same sensation in both shoulders

Inner and outer aspects of forearm

she has the same sensation in both sides

Thumbs and little fingers

she has the same sensation in both sides

Front of both thighs

she has the same sensation in both thighs

Medial and lateral aspect of both calves

she has the same sensation in both sides

Little toes

she has the same sensation in both sides

3.6.13.2. Deep tendon reflexes

Biceps

Right side= grade 2 (normal response) , Left side= grade 2 (normal response)

Triceps

Right side= grade 2 (normal response) , Left side= grade 2 (normal response)

Flexors

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

Finger jerk

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

Knee

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

Achilles tendon

Right side= grade 2(normal response) , Left side= grade 2 (normal response)

3.6.13.3. Kinesthesia

I grasped the patient's big toe and hold it away from the others toes to avoid friction. I showed the patient which movement is up and which is down. Then I asked the patient to close eyes and identify the direction I move the toe.

The patient was able to identify the direction I was moving her toe in both legs.

3.6.14. Breathing examination

In supine lying position I checked the breathing pattern by observation and placing my hands on patient's abdominal muscles and both sides of lower thorax. The movement was lateroventral and symmetrical in both sides.

3.6.15. Other special tests

3.6.15.1. Diaphragm Test: In sitting position with upright posture of the patient's spine I palpated with my hands on dorsolateral part, underneath the lower ribs and slightly against abdominal muscles. The patient asked to resist with the lower part of the chest expanding under my hands while maintain the spine to an erect posture. The patient was able to activate muscles against resistance with more force than before and during activation, the chest was expanding laterally.

3.6.15.2. Romberg Test I, II, III: negative

3.6.15.3. Trendelenburg Test: standing on right leg-negative

standing on left leg-negative but quite unstable

3.7. Evaluation of the effect of therapy

Patient had the operation of total hip endoprosthesis (left side) on January of 2012 and we started the therapy 3 years ago on 14th of January of 2015.

According to the initial kinesiological examination I estimated that after 3 years of the operation, some problems and limitations referring with the posture of patient, the movements of the spine, her gait pattern, the soft tissues and muscles, which my supervisor and I tried to improve them through physiotherapeutic procedures.

After the final kinesiological examination to the patient, I determined that the improvements were successfully but not completely in such a short time, so the patient be able to stop physiotherapeutic procedures.

Improvements have been done at posture in standing position concerning the lateral tilt of the pelvis and the trunk which limited and are closer to the level of the other side. Spine movements are more feasible to provide as the pain relieved and hypertonic muscles relaxed while weak muscles have strengthened and short muscles have elongated.

Release and improvement of the mobility of fascias of both sides also present. The gait pattern of the patient improved a lot as the patient is not walking with the help of crutches anymore and her gait has been closer to normal and more fluently than before.

Something last and very important is that the patient learned to activate correctly the core stabilization system under our instructions.

Below I include detailed description of the effect of the therapy.

Examination	Initial	Final
Posture	Distance between feet= 3cm	Distance between feet= 5 cm
Evaluation in standing	Left shoulder lower than right	Shoulders almost to the same Level
Dynamic test	Max. extension of spine with pain, restricted ROM	Max.extension of spine without pain, full ROM
	Max. lateral flexion of spine in both sides with pain, restricted ROM	Max. lateral flexion of spine in both sides without pain, full ROM on right side, limited ROM on left side
	Max. flexion of spine with pain, restricted ROM, 15cm fingers away from the floor	Max. flexion of spine without pain, increased ROM, 5cm fingers away from the floor
Gait examination	Without help of crutches, unstable gait, not in straight line, elevation of left side of pelvis	Without help of crutches, more rhythmic and synchronized gait, more stable steps from heel to toes, in straight line, with no elevation of the left side of pelvis
Muscle strength test	Gluteus medius Right side= 4 Left side= 4	Gluteus medius Right side= 4+ Left side= 4+
	Hip adductors Left side= 4	Hip adductors Left side= 4+
Muscle length test	Iliopsoas left side= grade 1	Iliopsoas left side= grade 0
Pelvis examination	Pelvis lateral tilt to the left	Less lateral tilt of pelvis to the Left
Muscle Tone	Gluteus maximus both sides= hypertonus	Gluteus maximus both sides= normal tonus

Examination	Gluteus medius right side= hypertonus	Gluteus medius right side= normal tonus
	Lower paravertebral muscles both sides= hypertonus	Lower paravertebral muscles both sides= normal tonus
	Iliopsoas left side= Hypertonus	Iliopsoas left side= normal Tonus
Soft tissue examination	Cervicothoracic in cranial direction and thoracolumbar in caudal direction restricted in both sides	Cervicothoracic in cranial direction and thoracolumbar in caudal direction released in both sides
Diaphragm test	Activate muscles against resistance with small force	Activate muscles against resistance with more force than before
	Chest expanding cranially	Chest expanding laterally
Trendelenburg test	Standing on left leg- positive	Standing on left leg- negative

Table 19: description of the effect of the therapy

All the above helped the patient to gain balance and managed her goals. Patient should continue exercising in order to improve.

Without the correction of her body posture and gait, the marked pelvic tilt will appear again, overuse of muscles will present, incorrect control of the balance and bad loading will be back and many other problems will carry also pain.

4. Conclusion

During my practice at Rehabilitační klinika Malvazinky I had the chance to treat a special case of patient who is after total hip endoprosthesis. What makes this patient different case from normal patient after total hip endoprosthesis is the situation that is after 3 years of operation and she developed some complications resulting pain on her spine.

Although the patient had as main goal to regain her balance of walking without crutches, I was in process to think and work with all elements that may cause the pain of the spine and the balance disturbances. In this way I was using various techniques that we have learned at university and I also had the chance to watch and learn more techniques from my supervisor Mgr. Hanka Zemlerová.

We had great cooperation with our patient and she was very positive without complaining. She was trying also hard to achieve her goal to regain her balance and we saw improvements through our therapeutic procedures, with the greatest improvement on her gait.

I am however satisfied with the results we have achieved during this rehabilitation program.

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6. SUPPLEMENTS

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- Figure 3: Transfer of weight to the lower limbs
Available at: Palastanga N., Soames R. (2012). *Anatomy and Human Movement* (6th ed.). Churchill Livingstone Elsevier. ISBN: 978-0-7020-3553-1.
- Figure 4: The gait cycle
Available at: <http://root2being.com/foot-shape-and-function/foot-function/>
- Figure 5: The role of LLD in standing position
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- Figure 6: Anterior pelvic tilt
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- Figure 7: Posterior pelvic tilt
Available at: <https://www.t-nation.com/training/>
- Figure 8: The most common local complications: limping and leg length discrepancy
Available at: Ochsner P.E. (2003). *Total Hip Replacement*. New York: Springer. ISBN: 978-3-642-62868-9.
- Figure 9: The rarer local complications
Available at: Ochsner P.E. (2003). *Total Hip Replacement*. New York: Springer. ISBN: 978-3-642-62868-9.

6.3. Abbreviations

ROM: Range of Motion

m.: muscle

LLD: Leg Length Discrepancy

L: Lumbar root

S: Sacral root

cm: centimeter

SIPs: Superior Inferior Posterior Spines

SIASs: Superior Inferior Anterior Spines

°: degrees

ADLs: Activities of Daily Livings

W/cm²: Watts per square centimeter

Hz: Hertz

TENS: Transcutaneous electrical nerve stimulation

BMI: Body Mass Index

Kg: Kilogram

NO: Number

DNS: Dynamic Neuromuscular Stabilization

6.4. Application for Ethics Board Review



CHARLES UNIVERSITY IN PRAGUE
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Application for Ethics Board Review

Undergraduate research

Project title: Case study of a patient with diagnosis of total hip endoprosthesis

Nature of the research project: Bachelor's thesis

Author (chief investigator): Maria Stylianidou

Supervisor (in case of student research): PhDr. Tereza Novakova

Research project description: Case Study of physiotherapy treatment of a patient with the diagnosis of Total Hip Endoprosthesis will be conducted under the expert supervision of an experienced physiotherapist to the orthopedic department of Rehabilitační klinika Malvazinky.

Guaranteed safety to be judged by experts: No invasive methods will be used. Personal data obtained during the investigation will not be published.

Ethical aspects of the research: special rationale for research involving children, pregnant and nursing women, mentally disabled, prisoners and persons in underdeveloped communities (see the Ethics Board Code, Faculty of Physical Education and Sport, Charles University, and International Ethical Guidelines 5, 6, 7, 8 and 11)

Informed consent (attached)

Date: 28.1.2015

Author's signature:

Faculty of Physical Education and Sport, Charles University in Prague ETHICS BOARD REVIEW

Ethics Board members: Prof. Ing. Václav Bunc, CSc.
Prof. PhDr. Pavel Slepíčka, DrSc.
Doc. MUDr. Jan Heller, CSc.

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, approved the research project.

Approval number: 026/2015

Date: 30.1.2015

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, reviewed the submitted research project and found no contradictions with valid principles, regulations and international guidelines for biomedical research involving human subjects.

The chief investigator of the project met the necessary requirements for receiving the Ethics Board approval.

UNIVERZITA KARLOVA v Praze
Fakulta tělesné výchovy a sportu
Josef Martího 31, 162 52, Praha 6

Official school stamp

1

Signature, REB Chairman

INFORMOVANÝ SOUHLAS

V souladu se Zákonem o péči o zdraví lidu (§ 23 odst. 2 zákona č.20/1966 Sb.) a Úmluvou o lidských právech a biomedicíně č. 96/2001, Vás žádám o souhlas k vyšetření a následné terapii. Dále Vás žádám o souhlas k nahlížení do Vaší dokumentace osobou získávající způsobilost k výkonu zdravotnického povolání v rámci

praktické výuky a s uveřejněním výsledků terapie v rámci bakalářské práce na FTVS UK. Osobní data v této studii nebudou uvedena.

Dnešního dne jsem byla odborným pracovníkem poučena o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měla jsem možnost klást mu otázky, na které mi řádně odpověděl.

Prohlašuji, že jsem shora uvedenému poučení plně porozuměla a výslovně souhlasím s provedením vyšetření a následnou terapií.

Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum:.....

Osoba, která provedla poučení:.....

Podpis osoby, která provedla poučení:.....

Vlastnoruční podpis pacienta /tky:.....